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UTAH HERPETOLOGISTS LEAGUE JOURNAL

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This organization was formed in January of 1974 and incorporated within the state of Utah under the title Utah Herpetologists League, a subsidiary of the Utah Zoological Society. The League is open to all individuals for membership, professional and non-professional alike. The objectives of this organization are as follows:

1. *To work towards conservation of Utah's species of reptiles and amphibians (protection where needed) and State Laws regulating their export and control.*

2. *To educate those interested concerning reptiles and amphibians so a better understanding will increase appreciation of these valuable animals.*

3. *To encourage field studies and laboratory research involving the Utah fauna, encompassing environment, geographical distribution, population dynamics, biologics, etc.....*

4. *To circulate data, photos, experiences, research and other information to the major zoos of this country and other interested institutions.*

Monthly meetings are held on the first Thursday at 7:30 p.m. Meeting location is the Utah Wildlife Resources Building, 1596 West No. Temple, Salt Lake City, Utah. Membership fees are as follows:

Regular Membership:	*5.00/year*
Contributing Member:	*10.00+/year*

Members receive the Newsletter and the League Journal and the right to attend all league meetings and participate therein.

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Right Photo: Celonese Cobra (*Naja naja naja*)

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ANOTHER ALBINISTIC WANDERING GARTER SNAKE

Hobart M. Smith, Preston Somers and David Chiszar
Department of EPO Biology (Smith) and Department of Psychology (Chiszar), University of Colorado, Boulder, and Department of Biology (Somers), Ft. Lewis College, Durango, Colorado

The two summaries extant (Bobrowsky, 1965; Hensley, 1959) of albinism in North American amphibians and reptiles indicate that no records existed at that time of albinism in any western species of *Thamnophis*. The more recent annual compilations of the Zoological Record and the fine bibliography on albinism by Gilboa and Dowling (1974), however, reveal the subsequent appearance of two nearly simultaneous records for *Thamnophis elegans vagrans* (Baird and Girard), by Banta and Hahn (1966) and Tanner (1966), from Colorado and Idaho respectively. A third case of albinism in the same subspecies has recently come to our attention and is of some interest for the record despite the previous registries.

The present specimen, a small female, now in the University of Colorado Museum, was presented to the second author by Dr. James G. Erickson, who found it at 88 Riverview Drive in the city of Durango, La Plata County, Colorado, on May 14, 1975. Total length 276 mm, tail 67 mm; scalerows 21-21-17; ventrals 162, caudals 78, anal entire; supralabials 8, infralabials 10, oculars 1-3, temporals 1-2-3. All scale characters fall within the normal range of variation (e.g. Tanner, 1950) of the subspecies. In preservative the specimen (not seen in life) is almost completely devoid of integumentary melanophores, yet the pattern of spots and the middorsal stripe are clearly evident anteriorly, discernible although dim at midbody; the posterior two-fifths of the body and all of the tail have no more than the vaguest vestiges of pattern. Presumably the distribution of other chromatophores (e.g. reduction where melanophores are normally present) accounts for the ghostly pattern, which is commonly evident in albinos and is described in both specimens recorded by Tanner (1966) and Banta and Hahn (1966). The only melanin evident with microscopic examination in our specimen is scattered very widely in single and in a few small groups of melanophores, not or barely visible to the naked eye, scattered on head, body and tail, both dorsally and ventrally. The iris is black. Such scattered vestiges of pigment require that the specimen be regarded as albinistic, not a complete albino.

The specimen reported by Banta and Hahn came from the upper levels of the Rio Grande drainage system, whereas the Durango specimen was taken in the Animas River Valley of the San Juan River drainage system - the former on Atlantic slopes, the latter on Pacific. Nevertheless the highlands whence these two systems originate are a physiographical and ecological unit, and the localities represented are but some 70 miles apart, suggesting the possibility that these two individual shared in a localized gene pool with exceptional preponderance of albinistic traits. Obviously the Idaho specimen could not have shared in the same gene pool, if indeed there is one. Yet

the rarity of albinism in western garter snakes in general is in marked contrast with its frequency in eastern garter snakes, and it seems not entirely to be explicable on the basis of the greater probability of discovery in the east where the density of observers is so much greater, especially since albino rattlesnakes are noted frequently. Garter snakes are far more abundant than rattlesnakes, although not always more conspicuous. Accordingly, the significance of the difference remains to be established.

We are indebted to Dr. Erickson for the snake here reported, now in the University of Colorado Museum.

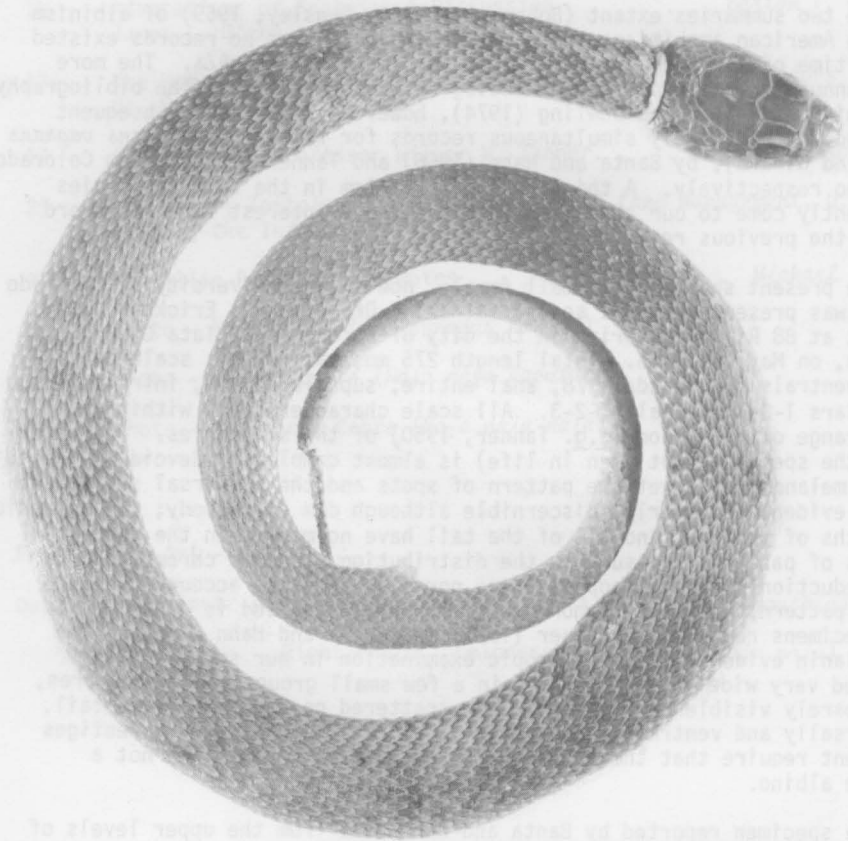

Figure 1. Albinistic *Thamnophis elegans vagrans*, Durango, Colorado. Photo by Kent M. Scudder.

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BIBLICAL ECOLOGY

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Recently considerable interest has been shown regarding the maintenance of the world's ecological system. This is attested to by the increasing number of organizations founded for the betterment of our environment, and increasing public interest in protecting wildlife. The Holy Bible contains many ideas that could be used to manage our eco-system. This communication is not intended to be an exhaustive study of the Holy Bible on this subject, but is merely a commentary on a portion of the information one can find documented in it regarding this subject.

Because there have been problems in translating certain passages in the Bible, certainty of definition has been established by examination of the original *Hebrew* language (2,3,5) for the *Old Testament*, and the *Greek* language (1,3) for the *New Testament* scriptures used. Several key *Hebrew* and *Greek* words which occur in the passages have been included in this report (see dictionary).

The Holy Bible (4) and James Strong's concordance of the Bible (3) were examined for the locations of the citations used. The list of *Hebrew* and *Greek* words was compiled directly from the Masoretic text (5) for the *Hebrew* words, and Berry's Greek Interlinear (1) for the *Greek*.

The Primordial Biotic System

Gen 1:11,12 *And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth: and it was so. And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good.*

Gen 1:20-22 *And God said, Let the waters bring forth abundantly the moving creature that hath life, and the fowl that may fly above the earth in the open firmament of heaven. And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind* (Dictionary, F), *and every winged fowl after his kind: and God saw that it was good. And God blessed them, saying, Be fruitful, and multiply, and fill the waters in the seas, and let fowl multiply in the earth.*

Gen 1:24,25 *And God said, Let the earth bring forth the living creature after his kind, cattle and creeping thing* (Dictionary, B), *and beast of the earth after his kind: and it was so. And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth* (Dictionary, B) *upon the earth after his kind: and God saw that it was good.*

Gen 8:17 *Bring forth with thee every living thing that is with thee, of all flesh, both of fowl, and of cattle, and of every creeping thing that creepeth upon the earth; that they may breed abundantly* (Dictionary, A) *in the earth, and be fruitful and multiply* (Dictionary, H) *upon the earth.*

Psa 136:5 *To him that by wisdom* (Dictionary, J) *made the heavens: for his mercy* (Dictionary, G) *endureth forever.*

Isa 45:18 *For thus saith the Lord that created the heavens; God himself that formed the earth and made it; he hath established it, he created it not in vain* (Dictionary, I), *he formed it to be inhabited: I am the Lord; and there is none else.*

In these passages we find that God is said to be the creator of the entire biosphere. It is stated that he used prudence and benevolence in forming it, and His purpose for this creation was for each creature to continue and to multiply in number. The earth, waters and skies were to be a place suitable for their inhabitants to dwell in and to propagate their species.

MAN THE ADMINISTRATOR

Gen 1:26 *And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing* (Dictionary, B) *that creepeth upon the earth.*

Gen 2:28-30 *And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish* (Dictionary, D) *the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree, in the which is the fruit of a tree yielding seed; to you it shall be for meat. And to every beast of the earth, and to every fowl of the air, and to every thing*

that creepeth upon the earth, wherein there is life, I have given every green herb for meat: and it was so.

Gen 2:15 *And the Lord God took the man, and put him into the garden of Eden to dress* (Dictionary, C) *it and to keep* (Dictionary, E) *it.*

Gen 9:2,3 *And the fear of you and dread of you shall be upon every beast of the earth, and upon every fowl of the air, upon all that moveth upon the earth, and upon all the fishes of the sea; into your hand are they delivered. Every moving thing that liveth shall be meat for you; even as the green herb have I given you all things.*

Psa 104:14-18 *He causeth the grass to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth; And wine that maketh glad the heart of man, and oil to make his face to shine, and bread which strengtheneth man's heart. The trees of the Lord are full of sap; the cedars of Lebanon, which he hath planted; Where the birds make their nests: as for the stork, the fir trees are her house. The high hills are a refuge for the wild goats; and the rocks for the conies.*

In these passages we catch a glimpse of man's relationship to nature, nature's relationship to man, and nature's own interdependence. These verses present *God* as bestowing upon man the responsibility for all of nature. Man was to preserve and nurture its balance and order. All plants and animals were available for man to use and enjoy as food.

ECOLOGICAL GUIDELINES

Ex 23:10,11 *And six years thou shalt sow thy land, and shalt gather in the fruits thereof: But the seventh year thou shalt let it rest and lie still; that the poor of thy people may eat: and what they leave the beasts of the field shall eat. In like manner thou shalt deal with thy vineyard, and with thy oliveyard.*

Lev 25:8,11 *And thou shalt number seven sabbaths of years unto thee, seven times seven years; and the space of the seven sabbaths of years shall be unto thee forty and nine years. A jubile shall that fiftieth year be unto you: ye shall not sow, neither reap that which groweth of itself in it, nor gather the grapes in it of thy vine undressed.*

Deut 20:19,20 *When thou shalt besiege a city a long time, in making war against it to take it, thou shalt not destroy the trees thereof by forcing an axe against them: for thou mayest eat of them, and thou shalt not cut them down* (for the tree of the field is man's life) *to employ them in the siege: Only the trees which thou knowest that they be not trees for meat, thou shalt destroy and cut down; and thou shalt build bulwarks against the city that maketh war with thee, until it be subdued.*

Deut 22:6,7 *If a bird's nest chance to be before thee in the way in any tree, or on the ground, whether they be young ones, or eggs, and the dam sitting upon the young, or upon the eggs, thou shalt not take the dam with the young: But thou shalt in any wise let the dam go, and take the young to thee; that it may be well with thee; that thou mayest prolong thy days.*

Prov 24:27 *Prepare thy work without, and make it fit for thyself in the field; and afterwards build thine house.*

Ecl 5:9 *Moreover the profit of the earth is for all: the king himself is served by the field.*

Included here are directions for the early Israelites on management of their biotic system. Every seven years for 49 years the land was to be allowed to rest in a fallow condition. All of the produce from the land was to be left for the poor people and the wild and domestic animals. The fiftieth was also to be a year of rest for the land and abundance for the animals. During a time of war in foreign territory respect was to be shown for the land's potential productivity. Even the people farthest removed from the activities of the field must remember they are served by the field in a very vital way. In order to insure the abundance of wildlife, breeding capability must be maintained. At least in a general way the outdoors must be preserved in preference to man's living conditions.

DISCUSSION

In the preceding pages it has been said that *God* exercised prudence in designing the ecological system. He made plants, and animals, and deemed them all good. Water, sky, and land are mentioned as various forms of habitat and plant or animal dependence upon them was indicated. All forms of life were created according to their kind or species and predisposed to giving birth, or reproducing more of their own kind. Man is utterly dependent on this biotic system, and was seen to pleasurably benefit while nature was allowed to thrive around him. He was given the responsibility to subdue and control the other occupants of the biosphere. He could make use of any plant or animal for food, and could till the earth, but he was to preserve nature's presence and balance. While it must be conceded that some plants

and perhaps animals may be more important than others over a short term, all wild plants and animals must be conserved by all mankind if we are to sustain our quality of life. Instructions were given in order to maintain conditions that would be beneficial to man. The individual was to exercise prudence in his daily activities to preserve wildlife, and its habitat. Periodically the whole nation of Israel was transformed into an ersatz game preserve. This enabled the plants, and animals to increase their strength, and numbers by growing and foraging over a larger area with a decrease in outside pressures. Man could have his times of plenty, but nature must have her's also. Nature was to be for the service of mankind, but man would have to earn the continuance of that service by giving priority to his consideration of wildlife resources, and secondarily to his domestic needs. This in turn would sustain the quality of his domestic life. Man must consciously exercise control and if necessary be willing to sacrifice in order to preserve the natural resources upon which he is totally dependent and given responsibility for. Agriculture must be allowed reasonable access to good land to sustain our food supply. We should re-examine our practice of populating the more hospitable fertile lands and leaving areas of harsh climate, or soil conditions to the farmer. Letting the dam fly from her nest to safety is an example of good wildlife conservation as the young could not survive on their own, whereas the adult could still reproduce. Without suitable habitat, life fails. Sufficient numbers of plants and animals must be allowed to live, and to bear young and inhabit the earth.

For motivation, if personal need was not enough, the psalmist in *Psalm 104* provided a beautifully poetic presentation of man's interdependence with the world's eco-system. It is said in *Rev 11:18: And the nations were angry, and thy wrath is come, and the time of the dead, that they should be judged, and that thou shouldest give reward unto thy servants the prophets, and to the saints, and them that fear thy name, small and great; and shouldest destroy* (Dictionary, K) *them which destroy* (Dictionary, K) *the earth.*

DICTIONARY

A.	*Breed abundantly*	שָׁרַץ	*Davidson:*	*Swarm with, produce abundantly, abound.*
			Strong:	*Swarm, abound.*
B.	*Creeping thing*	רֶמֶשׂ	*Davidson:*	*Reptile.*
			Strong:	*Reptile.*
C.	*Dress*	עָבַד	*Davidson:*	*Till, cultivate, labor.*
			Strong:	*Work, serve, till.*
D.	*Fill - replenish*	מָלֵא	*Davidson:*	*To be full, filled.*
			Strong:	*Fill, be full.*
E.	*Keep*	שָׁמַר	*Davidson:*	*Guard, preserve reserve.*
			Strong:	*Guard, protect, attend.*

F.	*Kind*	מִין	*Davidson:*	*Species, sort, kind.*
			Strong:	*A sort, i.e. species.*
G.	*Mercy*	חֶסֶד	*Davidson:*	*Kindness, favor.*
			Strong:	*To be kind.*
H.	*Multiply*	רָבַב	*Davidson:*	*Become many, numerous.*
			Strong:	*Increase.*
I.	*Vain*	תֹּהוּ	*Davidson:*	*Desolation, desert, emptiness.*
			Strong:	*Waste, desert, worthless.*
J.	*Wisdom*	בִּין	*Davidson:*	*Understanding, prudence.*
			Strong:	*Understand.*
K.	*Destroy*	διαφθειρω	*Berry:*	*Corrupt, decay.*
			Strong:	*Rot thoroughly, to ruin.*

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ADAPTATIONS OF SNAKES: A DISCUSSION

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All animals, through the action of specific selective pressures of their environment, have become better adapted to cope with their environment. Adaptations, which can include modifications of behavior, structure, and physiology, are a result of the expression of genetic information. This genetic information is shifted and sorted through the action of selective pressures to provide the best possible adapted animal to the particular situation.

Adaptations are very important for determination of taxonomic classification. Because these adaptations are selected to produce an animal which is better adapted to its particular habitat and niche, they can also be used to decipher the animal's specific position in the community and its native geographic locality.

Habitat not only includes the non-biotic features of the environment such as topography, geographical location, and meteorological considerations, but also includes biotic characteristics such as vegetation and animal relationships (predator-prey relationships and others). Niche defines the profession of the animal (what the animal does), and how it fits in the environment.

Snakes, like other animals, show both varied and complex adaptations to their habitat and niche. They share common adaptations with other animals as well as demonstrating many unique adaptations. As stated previously, adaptations can be considered as being structural, behavioral, or physiological, or any combination of these. Often there may be no clear cut distinctions between them.

Structural Adaptations

Coloration is a very important adaptation to the environment. In snakes, color plays a role not only in protection (warning or cryptic coloration), but also is important for thermoregulation and resistance to solar radiation. However, coloration is not of great importance for sex and species recognition for snakes as it is for other reptiles. Some mimic coloration may also occur in some species.

Members of the *Hydrophiidae* family illustrate many structural adaptations necessary to ensure their existence in a marine environment. Sea snakes are generally, characterized by an oar like tail (helpful in swimming), compressed bodies for floatation and to launch their strike from in the water, tight closing lips, and valve closures of the nostrils. Marine snakes also bear live young and have no ventral scales (they are unnecessary in the water) except for four species of the genus *Laticauda* which lay eggs on shore, necessitating the need for the large ventral scales.

Dasypeltis, a member of the Colubridae family, exemplifies a very specific structural adaptation to its niche. *Dasypeltis* is a non-venomous African snake whose diet consists of eggs. A projection of the vertebrate extends into the alimentary canal and slits the swallowed eggs in half. The contents of the egg are then digested and the shell is regurgitated. Folds in the mouth mucosa permit greater gape for swallowing.

The Mojave sidewinder (*Crotalus cerastes cerastes*), a rattlesnake of the desert which burrows under the sand, has a specialized scale over each eye. These scales are pushed down over the eyes by the sand while burrowing.

Burrowing snakes of all families generally have blunt heads and heavily scaled rostrals. These thick plates protect the snake's head from the pressure exerted during burrowing while also providing the snake with something hard to burrow with.

Other structural adaptations of snakes include the development of fangs for the injection of venoms, the prehensil tail of arboreal species, the narrow ventral scales of some true arboreal and burrowing species which allow greater flexibility, the development of the rattle of rattlesnakes for protection, the evolution of cutaneous breathing in a few *Natrix* (water snakes), the development of heat-sensory loreal pits in the *Crotalidae* (pit-vipers) family, and the heat sensitive labial pits of certain *Boidae* (boas and pythons).

Behavioral and Physiological Adaptations

One of the major behavioral and physiological adaptations of snakes of temperate climates, as well as other animals of temperate and arctic climates, is hibernation. This allows snakes to survive in a much more northern habitat than would normally be possible. Snakes are then able, by means of hibernation, to acclimatize to a changing environment resulting in an extension of their range and proliferation of their kind.

Snakes, like other poikilotherms, have developed behavior which permits them to regulate their body temperature to a limited degree. Basking is employed to obtain heat. The body may also be flattened during basking to create a greater surface area perpendicular to the rays of the sun, thus allowing additional heat absorption. During the hottest period of the day, snakes may move underground or undercover to escape from the heat.

Whether or not a venomous species of snake holds onto its prey after injection of its venom can be an indication of the type of habitat in which the snake lives. Arboreal species of snakes, besides often utilizing different prey (tree-dwelling prey), have developed the behavior of hanging onto prey. Terrestrial venomous snakes of the *Elapidae*, *Viperidae*, and *Crotalidae* families often dispense with the "hanging on" behavior, thus suffering less chance of injury by the biting or clawing prey animal.

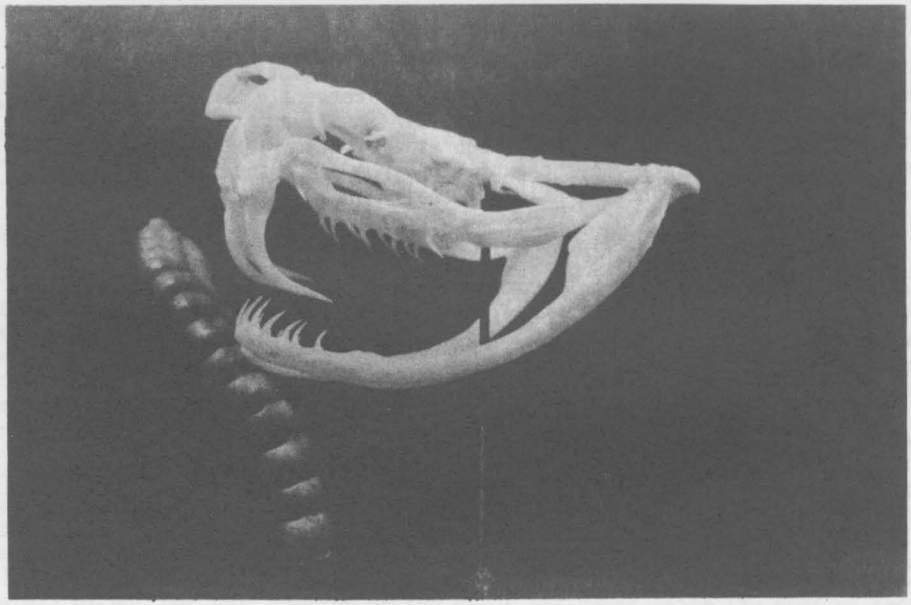
Other behavioral adaptations include nesting behavior, mimicry of venomous species behavior or nonvenomous species, as well as many others. It must be emphasized however, that although a snake generally shows certain behavioral characteristics, it also demonstrates individual behavior. This

is especially important for those who handle snakes by profession (scientists, zoo keepers, and others) to remember.

Some snakes, besides being able to regulate their body temperature to an extent by behavior, may also physiologically regulate their temperature to a very limited degree as do many other poikilothermic animals. One example of how they do this is by dilating surface blood vessels during basking, thus helping to transport heat into the body. To retain heat, the snake may constrict dermal blood vessels, allowing the heat in the blood to be contained in the body core to a greater extent. These processes are complex neurophysiological processes.

Another physiological adaptation is the production of venom. In association with the production of venom, structural modifications are also needed to store and deliver the venom, and behavior is also modified (striking behavior). Thus, it is evident that physiological, structural, and behavioral adaptations are in this instance closely interdependent and that each modification is necessary for the proper function of the venom apparatus as a whole.

There are many other adaptations shown by snakes. Adaptations are of utmost importance for the snake's survival in his environment. They are also very important to the scientist in the laboratory for gaining insight about the characteristics of the types of snakes being studied. Information about adaptations could also prove useful in management programs for threatened or endangered species.



Western Diamondback Rattlesnake (*Crotalus atrox*), photo by R.C. Straight.

THE NOT WELL-KNOWN "SIDEWINDERS" OF THE ASIAN DESERT ADDERS

(From Natur und Museum, 95(8). Frankfurt a.M., 1.8. 1965, in German)

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In this newspaper twelve years ago appeared an article in which I stated that some desert-inhabiting adders exhibit a truly remarkable form of locomotion, which is closely related to the peculiarity of their environment. It concerns the forward motion, the burrowing in the sand and oddly, their loud utterances. The observations refer to the North-African Horned viper (*Cerastes*), the South-west African Midget Puffadder (*Bitis*), and the horned rattlesnake (*Crotalus cerastes*) and the "Sidewinders" of western North-America. However, the way the scarcely better-known west-Asian *Pseudocerastes* and *Eristicophis* - whose mode of living is hardly known - behave in this relation, must out of lack of living specimens remained unknown. Only now through the steady growth of our herpetological collection during the last years from North-west Pakistan by Mr. M.G. Konieczny in Karachi in Senckenberg, can the gap in our knowledge be closed.

Both mentioned genera of adders each include only one species: They are *Pseudocerastes persicus* (with two subspecies), and *Eristicophis macmahoni* (not *mcmahoni* as Marx and Rabb, 1965, indicated). Both are pronounced "Sidewinders" with regard to their locomotion although they reveal true differences in adaptations to their environment - which is distinguished by the external dryness of the sandy floors and powerful solar irradiation. It is obvious at first glance that both are desert-inhabitors by their coloring, which is sandcolored. *Pseudocerastes* is greyish-yellow with slightly contrasting, somewhat darker cross-wise bands; in the case of *Eristicophis*, it is ocher yellow with a rectangular band of brown topped with white behind the eyes, and with spots of brown with some white scales scattered above, arranged in lateral rows along both sides of the body. Besides their coloring, these adders are adapted to their life in the desert through still other features, such as in the construction of the nasal openings, the closure of the mouth opening, the location and color of the eyes, as well as in their behavior, which will be shown in the following.

Compared to their well-known Northafrican-Southwestasian relatives, the Efas (*Echis*) and Horned vipers (*Cerastes*), they appear, to be sure, less specialized. They lack namely, the peculiar ability to produce rattling sounds by means of body movements instead of by hissing. This rattle is based on the fact that an Efa or a Horned viper executes a coiling movement with its body, without changing its location. They will then rub the serrated keels of their side scales together, producing sounds which are deceptively similar to

hissing. This behavior is especially suitable for inhabitors of sandy regions, while the hissing, which these adders are no longer capable of, consists of not only a strong expulsion of air, but also each time a powerful inhalation. The latter however, endangers the air passages because of the possibility of intrusion of sand particles. Such "perfection" is exhibited with neither *Eristicophis* nor *Pseudocerastes*: both are capable only of a very powerful hissing for their defense.

Comparing *Pseudocerastes* with *Eristicophis*, it is surprising that the first genus, in scale-covering, is less varied than the last. *Pseudocerastes'* scales differ indeed only slightly from the well-known genus *Vipera*, while in the case of *Eristicophis* the dorsal scales are perpendicular to the longitudinal axis of the body, consequently no oblique transverse rows are formed; the ventral markings have strong side-keels, and above all, the tip of the nose is scaled in a very odd manner: The nose-plate is very broad, but low and bulges out sharply downward. Furthermore, it is equipped on the upper edge on each side with a very large scale, so that a picture of butterfly wings arises (Marx & Rabb, 1965). This kind of structure corresponds with not less peculiarly formed jaw-bones, which the named authors at first described.

In the case of such nose-scales one must think of a digging tool, since *Eristicophis* is certainly a sand-inhabitor. To be sure, Marx & Rabb have overlooked this habit of *Eristicophis*. However, I now have in my possession a female adder which is repeatedly busy pushing forward and withdrawing its head with shoveling of sand (making a hole for her laying of eggs-(Gelege)?). It is also a well-known activity of one of the Horned vipers, for which the strange nose-scales are excellently suited. The nose-scales however, are never used as a shovel when the adder with greater dexterity is attempting to burrow itself in fine sand. The burrowing is executed, rather, by a lateral, from back-to-front progressing movement of the keeled ventral scales. For this process, the perpendicularly-placed rows of dorsal scales may be more appropriate than the obliquely-arranged rows. As soon as the torso has disappeared in the sand, the top of the head becomes covered with sand by means of a pair of turns along its longitudinal axis. Buried under the sand is the resting-place of a healthy *Eristicophis* during the day; *Pseudocerastes* is in no position to burrow-in, but hides from the day-light in holes or under rocks or in other hiding places.

Both adders are twilight and nocturnal animals. At the onset of darkness their activity begins, and then one also has the opportunity to observe their peculiar locomotion. Both are qualified in the simple winding movement. These movements will appear when they are traveling undisturbed and cautiously through their terrain. *Eristicophis* advances occasionally for a short distance also in a "Caterpillar-movement" - slow creeping in a straight line. But if an adder is frightened and prepares to go at a faster speed, the snake will immediately change into a side-winding motion, whereby the snake doesn't move in a straight direction, but rather in a lateral-forward motion. In side-winding, contrary to simple winding where the entire body touches the base, the body instead touches on only two small points, shifting from front to back. Consequently, the weight of the snake will be distributed only on these two points and through this produces on a compliant (or completely smooth) base, a more favorable resistance, as if the adder with its entire body rested on the sand. The short and thick adders can, on a compliant surface, obtain in

this manner also a greater speed than by a simple winding (Mertens, 1953). Quite convincingly, Brain has shown (1960), that the winding movement must necessarily change into a sidewinding movement as soon as the snake lifts parts of its body upward by moving forward.

Therefore the sidewinding is no real exception - one can distinguish between the real and occasional sidewinders. As I first stated (1953:155) this type of locomotion is especially characteristic of the short midget puff adder of Namib, *Bitis peringueyi*, which as an observation has been completely overlooked by Brain (1959, 1960). There are accordingly snake genera (*Bitis*, *Crotalus*), which in addition to the simple type of winding locomotion significantly include sidewinding as well. Should it be proven that the equally-qualified for sidewinding, *Pseudocerastes persicus* indeed does not represent a specific genus and is placed with the *Vipera*, then that would be no exception. As far as speed is concerned, it appears that *Eristicophis* is superior to *Pseudocerastes*, probably due to *Eristicophis*' keeled ventral scales which produce a greater resistance on the sand.

Marx and Rabb mention for *Eristicophis* a gripping tail, which is used during activity for climbing in the brush. This adder is indeed capable of some climbing in branches, which other adders are also capable of. However, I have not noticed an effective support by their tails to be used in climbing. I saw climbing Horned vipers; also Namib adders (*Bitis peringueyi*); even the sidewinding rattlesnakes (*Crotalus cerastes*) are well-known for their climbing ability in the brush.

Furthermore, the same is also expected for *Pseudocerastes persicus*, since the adder likes to eat birds. In any case, an adder which has been nourished by my meals since July 2, 1962, consequently in my possession for almost three years, in recent times has eaten exclusively sparrows, even dead ones; at first, the adder took white mice only seldomly and irregularly, then it declined into a 3/4-year hungerstrike, which ended when a sparrow was layed in front of her. For the last 1-1/2 years it has received a sparrow approximately every two weeks. Once the adder even mastered a dead blackbird after a very long process of devouring. In contrast to *Pseudocerastes*, *Eristicophis* prefers lizards as food, which they will take up to the size of a full-grown Emerald lizard. In this case, the effect of the venom is remarkably weak, since an Emerald lizard was held fast by an *Eristicophis* for 37 minutes and then released again, and ran away without any hinderance, and not until 24 hours later was it again seized and devoured. That of course doesn't mean that the *Eristicophis* venom won't act completely on other warm-blooded animals, including man. So was the life of our corresponding member, Mr. Konieczny seriously endangered after an *Eristicophis*-bite in spite of treatment with polyvalent serum.

Both adders live in sand-filled terrain, staying close to the heating element. The floor-temperature during the day is up to 26°C, the air temperature is usually 2-3 degrees less. During the night a cooling-off to 20-23°C sets in. During the summer on most over-cast days the temperature will not get as high. Both snakes normally supply their water needs by means of marsupials, and one also occasionally sees them drink from their water dishes. That was especially frequent to observe for *Pseudocerastes* during its hunger-strike. Concerning the reproduction of both types, it is up till now not

well-known. One would like to assume however that *Eristicophis*, like *Cerastes*, lays eggs, while *Pseudocerastes* perhaps gives live-birth.

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(Dr. Robert Mertens succumbed August 23, 1975, following envenomation by a "Bird or twig" snake (*Thelotornis kirtlandi*). The article presented herein is indicative of his acute observations of reptiles. Dr. Mertens will long be remembered as one of history's greatest Herpetologists).

A TRIBUTE TO PROFESSOR WILMER W. TANNER

Utah's Dean of Herpetology

The Editorial Staff

When Wilmer W. Tanner left his father's ranch in Fairview, Utah over 40 years ago, he went to Brigham Young University with the notion to study dramatic arts, debate and history. However, after a few classes in geology, chemistry and biology he switched to biological sciences where he has made a very distinguished career.

Dr. Tanner earned his bachelor's and master's degrees at B.Y.U. in 1936-37; he taught science in Provo City schools from 1937-1946; and then went to the University of Kansas for his doctoral degree. He returned to Utah in 1949 to join the B.Y.U. faculty as Associate Professor of Vertebrate Zoology. Currently he is Professor, Department of Zoology and Entomology and Curator of the B.Y.U. Life Sciences Museum.

Dr. Tanner is an internationally recognized scientist, author, curator and herpetologist and is recognized especially for his work in anatomy, ecology and systematics of reptiles. He served eight years as editor of *Herpetologica*, the scientific journal published by the Herpetologists' League. He has served as president of the League, the American Association of Academics of Science and the secretary-treasurer of the Utah Academy of Sciences, Arts and Letters.

His scientific and educational accomplishments are evidenced by the fact that he received the Distinguished Service Award from the Herpetologists' League and was the first recipient of the Faculty Achievement Award presented by the B.Y.U. College of Biological and Agricultural Sciences.

Dr. Tanner has personally collected thousands of vertebrate specimens in the western United States and Mexico and has donated them to B.Y.U.'s Life Sciences Museum. It is largely to his credit that B.Y.U.'s 40,000-specimen herpetological collection is one of the largest in the Intermountain West.

The editors of the Utah Herpetologists' League journal are pleased to present Dr. Tanner's distinguished bibliography in this issue.

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THE DESERT TORTOISE
(*Gopherus agassizii*)
IN UTAH

Bureau of Land Management
U.S. Department of the Interior
Cedar City District, Utah

The Beaver Dam Slope

Visitors to the Beaver Dam Slope in extreme southwestern Utah experience an environment found nowhere else in Utah. This area of Joshua trees, creosote bush, cholla, and barrel cactus contains one of Utah's rare and unusual wildlife species, the desert tortoise (*Gopherus agassizii*). The Beaver Dam Slope is the northern-most range of the desert tortoise which is also found in the deserts of Nevada, California, Arizona, and Sonora (Mexico).

The tortoise deserves respect for merely surviving in this hostile environment. Severe conditions include long droughts, flash floods, large temperature fluctuations, extremely hot summers, and sparse vegetation. Through thousands of years the tortoise has adapted physically and behaviorally to life in the desert.

One adaption of the tortoise is a long life span. Individuals mature between twelve and eighteen years of age and some live fifty years or longer. A long life span is important because of the high mortality of eggs and hatchlings. The shells of young tortoises are soft, hardening only after five to ten years. While the shells are soft and the young tortoises are at the mercy of most predators they encounter.

When not looking for food, the tortoise spends much of its time underground in burrows. This behavioral adaptation allows the tortoise to escape the harsh desert climate, thereby conserving moisture and energy.

Spring and summer burrows are relatively shallow. Some tortoises use several summer burrows while others return to the same burrow each night. In extremely hot weather the tortoises remain in the burrows during daylight hours.

Larger burrows are used for hibernation in the winter where tortoises congregate. Some dens contain as many as 25 tortoises. Soil conditions suitable for construction of these winter dens are essential to tortoise survival.

Status in Utah

Past studies indicate that as many as 1,000 to 2,000 tortoises may have been on the Beaver Dam Slope. The present population of this area is estimated to be between 200 and 300, probably an all time low. At present, reproduction is probably less than the death rate, therefore, the population is declining.

Decline in tortoise numbers is partly attributed to collecting by humans and to habitat changes. In the past large numbers of tortoises were collected as pets. Reduction of perennial grasses is the primary habitat change and these plants are apparently essential to tortoise survival and reproduction.

In 1971, Utah classified the desert tortoise as a protected species. Collecting or possessing tortoise is now illegal in Utah!

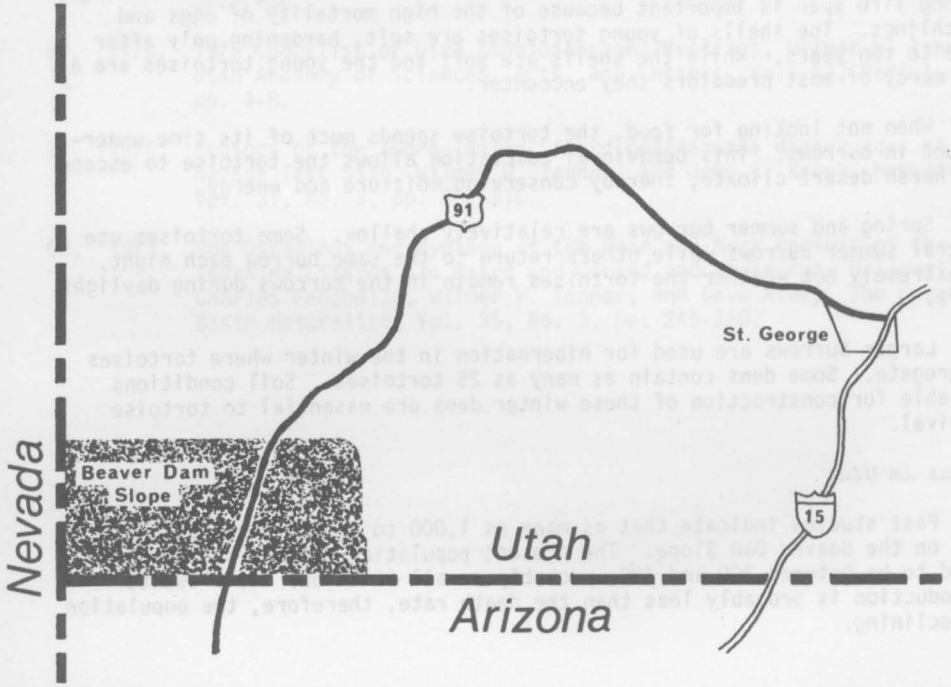
Because most of the Beaver Dam Slope is national resource lands managed by the U.S. Bureau of Land Management, the BLM is very concerned about the welfare of this tortoise population.

How the Public Can Help

You can protect tortoise habitat by observing the following:

1. Do not litter.
2. Keep vehicles on established roads.
3. Do not damage vegetation.

Enjoy the tortoise on your national resource lands. Help protect the tortoise and its habitat for others to enjoy.



REPTILIAN REPRODUCTION NOTES

Boidae Reproduction Data

Michael T. Coffeen

Boa constrictor imperator (Central American boa) male
+
Boa constrictor constrictor (common boa) female

(2nd captive breeding, previous birth data, UHLJ, Vol. 1, #1, pp 19, 1974.)

Breeding: August 27 - October 10, 1974.

Birth date: March 24, 1975

Note: 16 male (1 runt) + 18 female, only 8 survived due to clustered cramped ova-position in female. Weights do not include yolks which were all external at birth. Also 8 infertile yellow ova mass.

	Range	Mean	Variance	Std. Dev.	Std. Error of Mean	# Specimens
Combined Sexes						
Total length (inches)	17.25-20.25	18.9	0.47	0.68	0.12	33
Weight (grams)	31.1-65.3	45.8	41.18	6.42	1.12	33
Dorsal blotches to vent	17-23	19.4	1.82	1.35	0.23	33
Dark tail blotches	3-5	3.7	0.27	0.52	0.09	33
Males						
Total length (inches)	18-20.25	19.0	0.36	0.60	0.16	15
Weight (grams)	31.1-65.3	45.7	63.60	7.98	2.06	15
Dorsal blotches to vent	17-23	19.3	2.60	1.61	0.40	15
Dark tail blotches	3-5	4.0	0.13	0.37	0.10	15
Females						
Total length (inches)	17.25-20.25	18.8	0.57	0.76	0.18	18
Weight (grams)	39-52	45.9	25.10	5.01	1.18	18
Dorsal blotches to vent	18-22	19.6	1.31	1.15	0.27	18
Dark tail blotches	3-4	3.5	0.27	0.51	0.12	18

Parent female - 61 inches, 25 dorsal blotches to vent, 3 tail blotches.

Parent male - 68 inches, 25 dorsal blotches to vent, 5 tail blotches.

Herpetology Department
Hogle Zoological Gardens
Salt Lake City, Utah

James L. Glenn, Michael P. Coffeen, Robert Larsen and Dan Beck

Boa constrictor constrictor (common boa)

Breeding: December 1-13, 1974

Birth date: June 9, 1975 AM (7 month gestation)

Notes: Parent female captive 21 years, approximate age 25 years. Female x-rayed during 3rd month gravidity, treatment during 4th month with lengthy dose regimen of antibiotics for respiratory problems and with "Flagyl" for protozoans. Female refused food throughout gravidity; tube-fed beef, chicken broth, egg and ABDEC vitamin mixture every 2 weeks. Voluntarily fed 4 hours following birth of young. Siblings healthy and vigorous at birth, reproductive capabilities unknown.

	Range	Mean	Variance	Std. Dev.	Std. Error of Mean	# Specimens
Males						
Sn-vent length (inches)	16.4-17.7	16.9	0.16	0.40	0.12	11
Tail length (inches)	2.3-2.75	2.5	0.01	0.12	0.04	11
Weight (grams)	62.1-77.3	68.6	20.9	4.6	1.38	11
Dorsal blotches to vent	21-24	22.2	0.96	0.75	0.24	11
Tail blotches	3-5	4.0	0.2	0.45	0.14	11
Females						
Sn-vent length (inches)	15.9-17.8	17.0	0.43	0.65	0.25	7
Tail length (inches)	2.1-2.5	2.26	0.03	0.17	0.07	7
Weight (grams)	66.1-75.2	71.1	10.90	3.3	1.25	7
Dorsal blotches	20-23	21.71	0.91	0.95	0.36	7
Tail blotches	3-4	3.8	0.20	0.45	0.20	7

Herpetology Department
Hogle Zoological Gardens
Salt Lake City, Utah

Colubridae Reproduction Data

Michael P. Coffeen

Lampropeltus getulus californiae (California King snake)

(Captive bred)

Eggs laid: 5-15-75, female wrapped tightly around clutch of 5 eggs. Mean egg size = 2.2 cm x 6.4 cm, 19.2 grams.

Eggs hatched: 7-15-75, 2 eggs infertile.

Sex	Total Length (inches)	Weight (grams)
(ringed)	10.5	12.4
(striped)	12.5	14.1
(ringed)	11.25	11.0

Crotalidae Reproduction Data

James L. Glenn, Richard C. Straight, Clifford C. Snyder and Robert Larsen

Crotalus cerastes cerastes (mojave sidewinder)

Breeding: June 11, 12, 1975, VRL, V.A. Hospital.

Birth Date: October 31, 1975, VRL, V.A. Hospital (4½ months gestation).

Note: Parent female fed throughout gravidity. Siblings tube fed for 5 weeks, (80%) voluntarily fed after 5 weeks on new born mice.

	Range	Mean	Variance	Std. Dev.	Std. Error of mean	Sum of x	# Specimens
Combined sex							
Total length (mm)	144-150	146.4	5.6	2.4	0.75	1464	10
Total length (inches)	5-3/4-6.0	5.86	-	-	-	-	10
Total weight (grams)	4.2-5.7	4.93	0.21	0.46	0.15	49.3	10
Parent female							
Total length (mm)	527.5						
Total length (inches)	21.1						
Post-partum weight (grams)	139.7						

Venom Research Laboratory
Veterans Administration Hospital
Salt Lake City, Utah

Viperidae Reproduction Data

Vipera russellii russellii (Russells viper)

James L. Glenn, Richard C. Straight and Clifford C. Snyder

Two gravid female russells vipers were received from Calcutta, India on May 10, 1970. Both snakes produced young on July 15, 1970. The litters numbered 33 and 26 (2 dead) and weights ranged from 4 to 6 grams (premature?) each and lengths ranged from 6 to 7.5 inches (15 to 19 cm). We attempted to extract venom from all 57 young the first day of birth. The technique used was applying manual pressure to the venom glands with the fangs exposed over a rubber covered vial. Many snakes bit savagely into the rubber covering with no discharge of venom. Total venom collected was approximately .01cc. Twenty-one days following birth the same procedure was used to extract venom from the 57 young and a total of .2cc was accumulated, many individual snakes produced nothing. The snakes had been housed communally in four separate containers, so some snakes could well have lost venom in striking at cagemates. Venom production often begins in the embryonic state. The reason for the minute amount of venom collected at birth in this case is unknown.

The day following birth, all 57 young were tube fed a mixture of beef and chicken broth, egg and multiple vitamins (ABDEC). This diet was continued at 1 week intervals thereafter until 72% had fed voluntarily on new born mice by the 3rd month.

Three incidents of cannibalism occurred during the 3rd month when feeding dates were extended beyond 1 week. Cannibalism increased rapidly (with suffocation usually overcoming the aggressor) after 4 months, when feeding was not maintained weekly. Cannibalism in adult russells vipers is probably very rare, however, the young may revert to this horrible trait for a percentage survival and not retain the behavior as adults.

Venom Research Laboratory
Veterans Administration Hospital
Salt Lake City, Utah

ANNOUNCEMENT

The University of Kansas Museum of Natural History will publish in early fall 1975 a book entitled "Edward H. Taylor: Recollections of a Herpetologist." This new book contains:

Philippine Adventures: An autobiographical Memoir by Edward H. Taylor

Edward Harrison Taylor: The Teacher by A. Byron Leonard

The Blazing of a Trail: The Scientific Career of Edward Harrison Taylor by Hobart M. Smith

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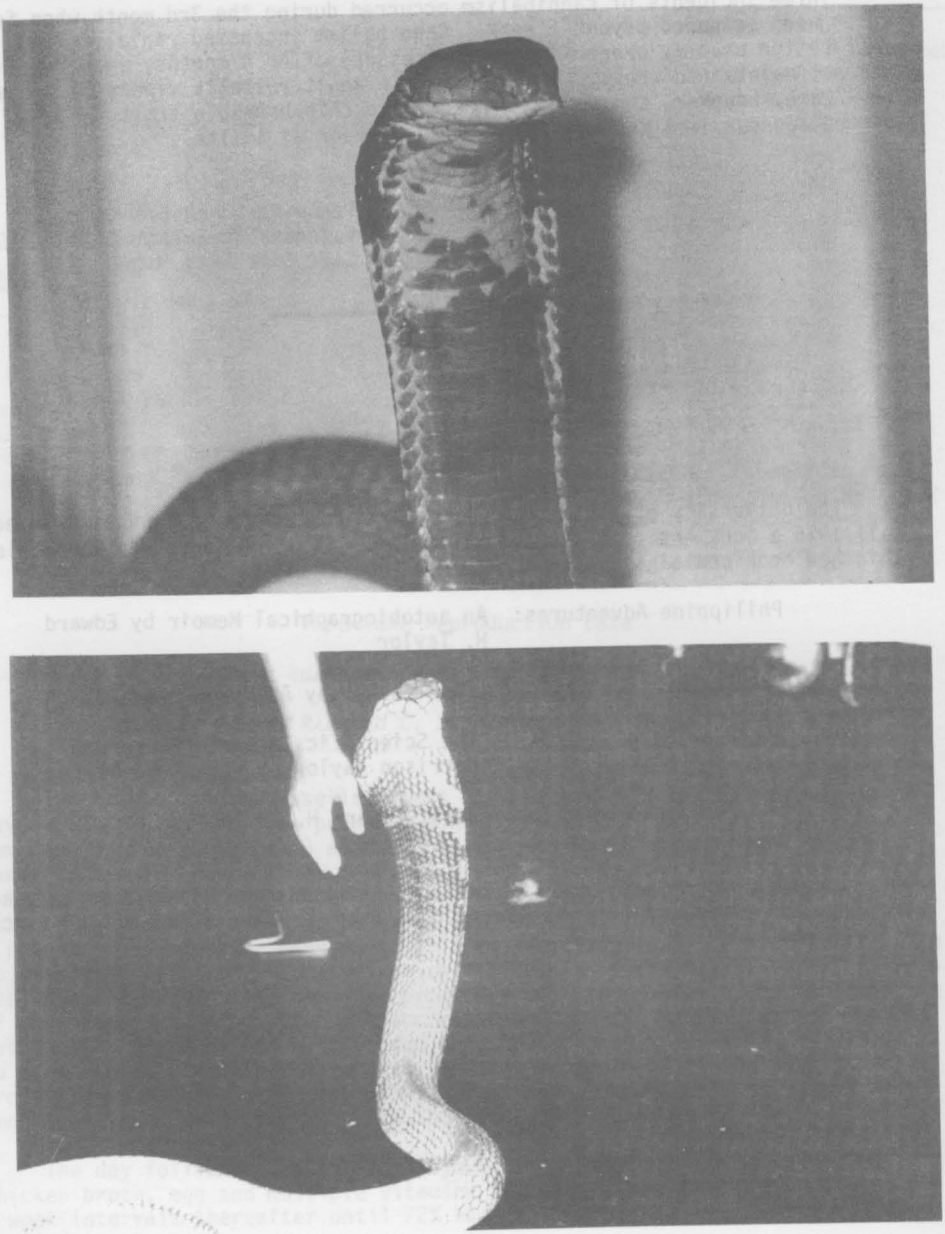
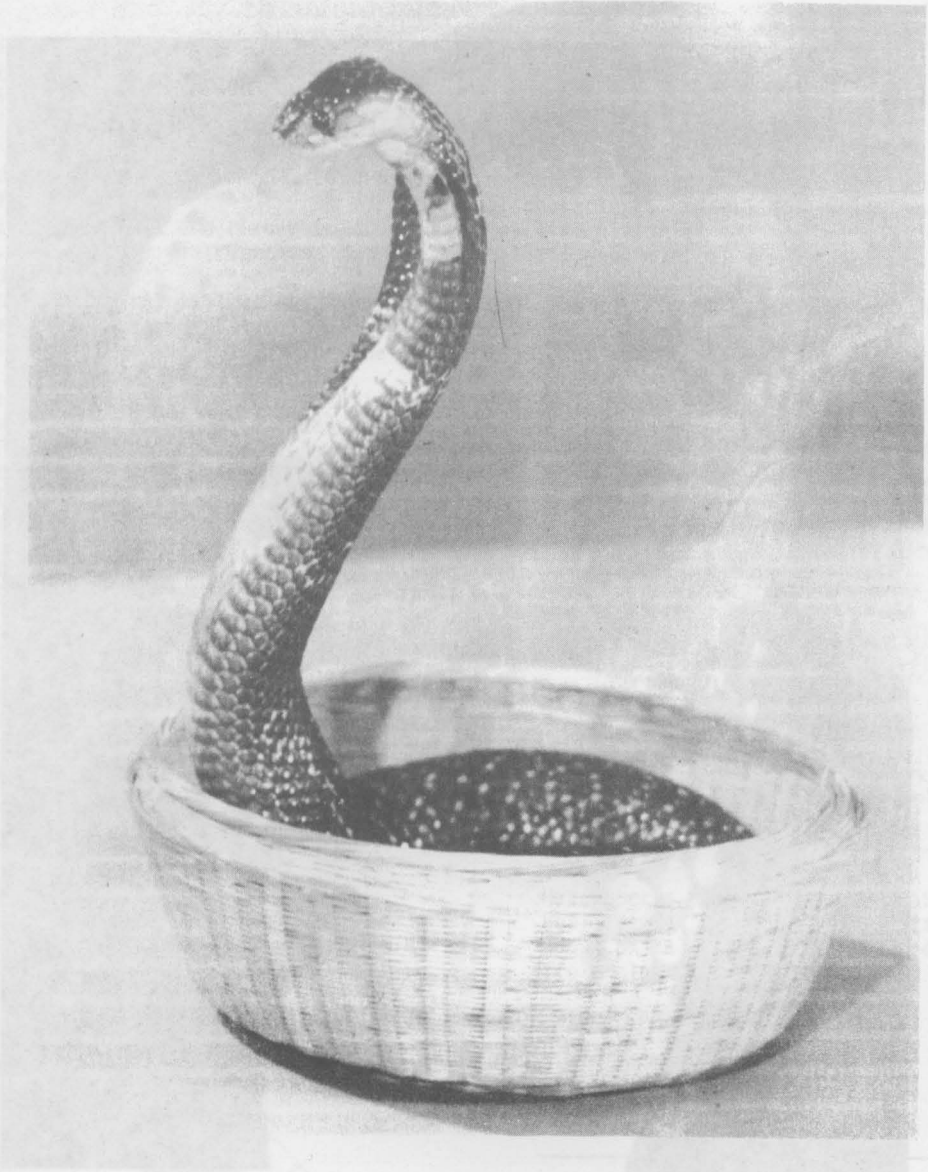
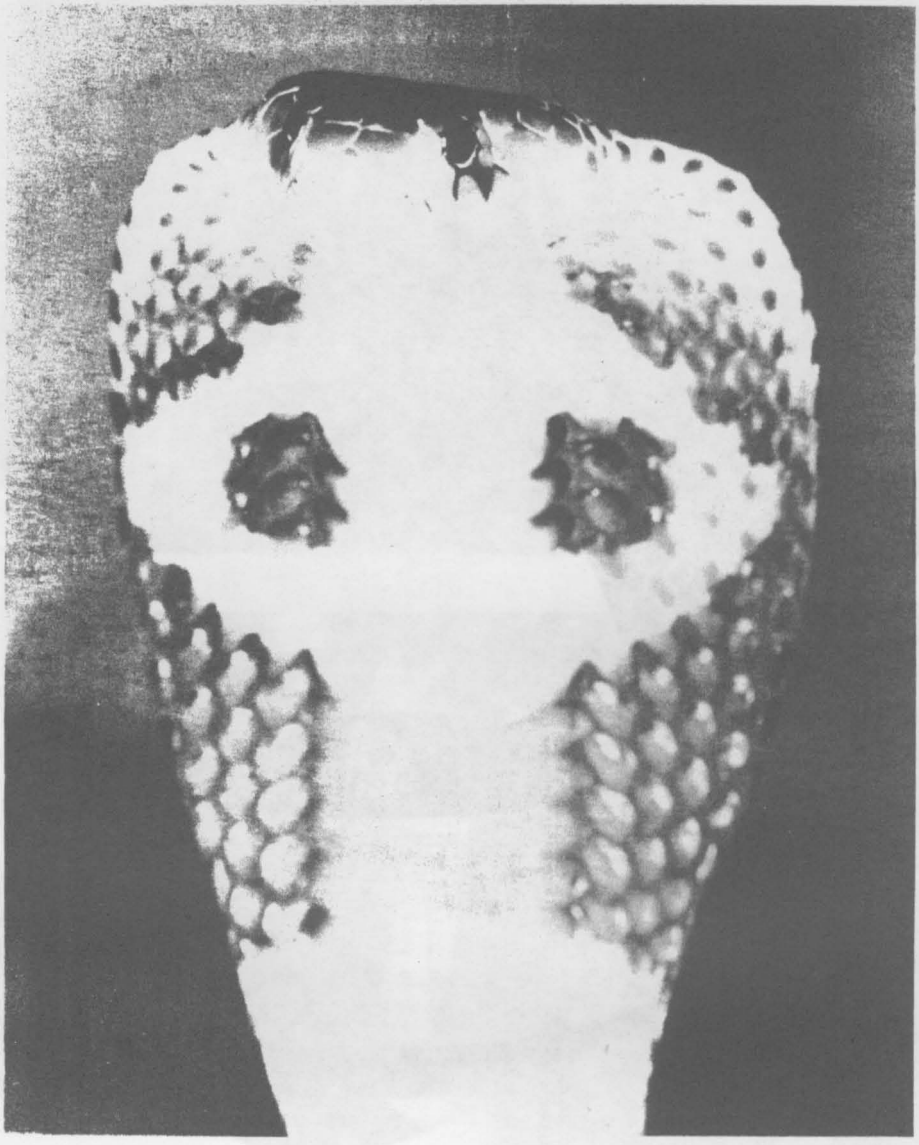
The book may be ordered from Publications Secretary, Museum of Natural History, University of Kansas, Lawrence, Kansas 66045. Price: $6.00 (including postage and handling).



King Cobra (*Ophiophagus hannah*), photo by R.C. Straight, Venom Research Laboratory, V.A. Hospital, Salt Lake City, Utah.



Common Cobra (*Naja naja kaouthia*), photo by RMEC Division, V.A. Hospital, Salt Lake City, Utah.



Ceylonese Cobra (*Naja naja naja*), photo by RMEC Division, V.A. Hospital, Salt Lake City, Utah.

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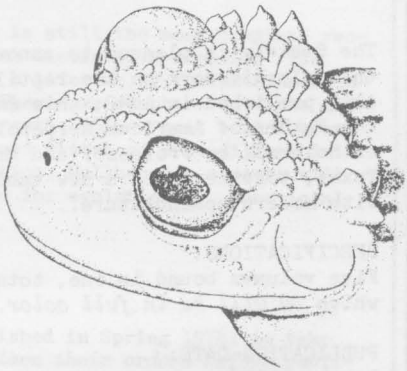

FIG. 54. Head of *Anotheca spinosa* (K.U. No. 58076) showing extreme condition of cranial spines. × 3.

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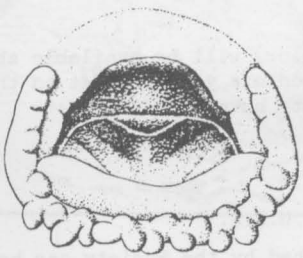

Fig. 99. Mouth of tadpole of *Hyla subocularis*, K.U. No. 116784. × 45.

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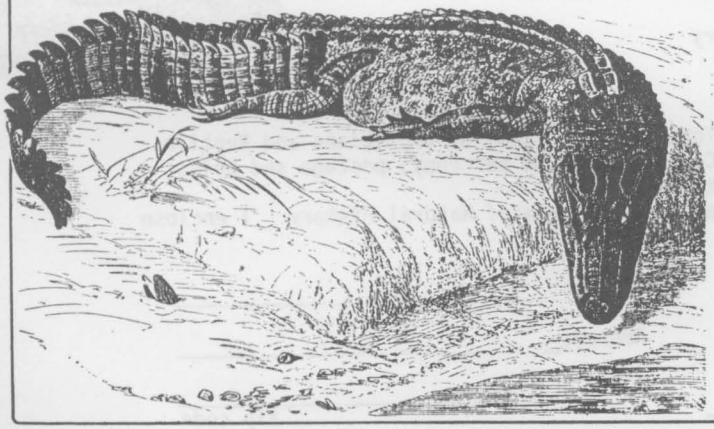

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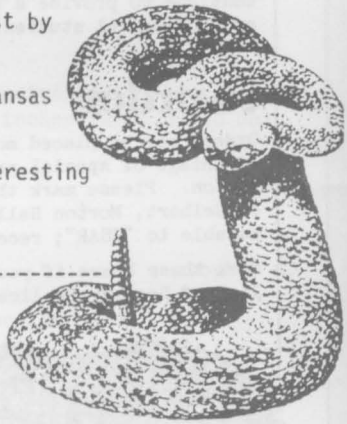

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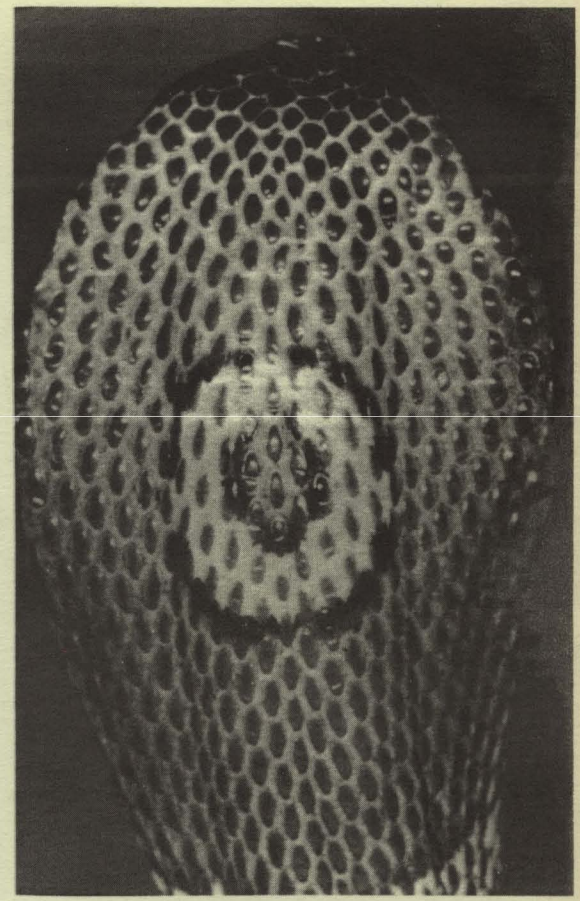
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